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Metacontingencies, Experimentation and Nonhumans: Searching for Conceptual and Methodological Advances

Metacontingencias, experimentación y no-humanos: En búsqueda de avances conceptuales y metodológicos

Recibido: Diciembre 26 de 2011
Revisado: Enero 26 de 2012
Aceptado: Febrero 19 de 2012

Saulo Missiaggia Velasco
Marcelo Frota Benvenuti
Gerson Yukio Tomanari
University of São Paulo, Brasil

This research was supported by grants from Conselho Nacional de Ciência e Tecnologia (CNPq) and Fundação de Apoio à Pesquisa do Estado de São Paulo (FAPESP)

Department of Experimental Psychology, University of São Paulo. Av. Prof. Mello Moraes, 1721, São Paulo, SP 05508-030, Brasil. E-mails: saulovelasco@gmail.com, mbenvenuti@yahoo.com, tomanari@usp.br

Resumen

La metacontingencia ha sido descrita como la relación funcional entre las contingencias conductuales entrelazadas, junto con su efecto directo e inmediato, llamado producto agregado, y un evento seleccionador dependiente de dicho efecto, llamado consecuencia cultural. El análisis metacontingencial permite la discusión de la complejidad del comportamiento humano en los sistemas sociales. En el presente estudio, quisimos revisar y discutir: (a) la importancia del análisis de procesos conductuales básicos para la comprensión de los fenómenos sociales humanos; (b) la necesidad de construir y mejorar los modelos experimentales de metacontingencias; (c) el estado actual de las investigaciones experimentales en metacontingencias; (d) el uso de modelos animales como forma de controlar los efectos de la conducta verbal, entre otras variables, sobre la selección cultural; (e) una propuesta concreta e ilustrativa de un modelo animal de metacontingencias.

Palabras Clave: Metacontingencias, Contingencias entrelazadas, Prácticas culturales, Experimentación, no-humanos.

Abstract

Metacontingency has been described as the functional relation between interlocking behavioral contingencies, plus their direct and immediate effect, called aggregated product, and a selecting event dependent of such effect, called cultural consequence. The metacontingencies analysis enables the discussion of human behavior complexity in social systems. In the present study, we aimed to review and discuss: (a) the importance of basic behavioral processes analysis for the comprehension of social human phenomena; (b) the necessity of constructing and improving metacontingencies experimental models; (c) the current state of metacontingencies experimental investigations in humans; (d) the use of animal models as a way to control the effects of verbal behavior, among other variables, over cultural selection; (e) a concrete and illustrative proposal of an animal model of metacontingencies.

Key-Words: Metacontingencies, Interlocking Contigencies, Cultural Practices, Experimentation, Nonhumans.

Behavior analysts are quickly advancing on the study of complex behavioral phenomena, which are directly relevant to our society and to the construction of applied strategies and effective technologies to deal with behavior. This is so positive, but it could wrongly suggest that a basic science and the solid formation in the analysis of basic processes are unnecessary and outdated. Certainly, to act on the complexity, the clarity of what dimensions of the complex phenomenon are for the psychologist to handle is necessary. It is the research, and especially the experimental basic research, what makes this clarity possible. As discussed by Sidman (1960), experiments can be accomplished to test new hypotheses, to test new methods or techniques of investigation, to establish the existence of a behavioral phenomenon or to explore the conditions under which a phenomenon occurs. Through basic experimentation, we identify the functional relations between behavioral events; we learn to think in abstraction and to extract from reality the psychological dimensions that compose a complex phenomenon. The present article discusses: (a) the importance of basic behavioral processes analysis for the comprehension of the social human phenomena; (b) the necessity of experimental models of metacontingencies to be built and improved; (c) the current state of experimental investigations of metacontingencies in humans; (d) the use of animal models as a form of control of the effects of verbal behavior, among other variables, on cultural selection; (e) a concrete and illustrative proposal of an animal model of metacontingencies.

Social behavior analysis

The book *Principles of Psychology* by Keller and Schoenfeld was published in 1950 and was intended to promote ideas of a group of psychologists "unflaggingly on the lookout for fundamental principles of behavior – principles which hold true for white rats as well as the college student, for the dog in laboratory harness as well as the patient on the psychoanalyst's couch, for the tribal savage as well as the sophisticated product or our own culture" (Keller & Schoenfeld, 1950/1995, p. xvii). Consistent with its proposal, the first manual of behavior analysis presents and discusses principles such as reinforcement, extinction, reconditioning, generalization and discrimination and debates incredibly current examples and extrapolations for the complex human behavior. In the closing chapter, *Social Behavior*, students and professionals of Psychology may be surprised when they find statements like "it is difficult, if not impossible, to think of a single operant activity of the individual which does not show in some degree the pervasive influence of his community's teaching" (p. 363) or "the 'self' and 'consciousness' are the creations of human society operating on the individual by means of verbal training" (p. 371).

At the beginning of the *Social Behavior* chapter, there is also anvery interesting analysis, in which Keller and Schoenfeld (1950/1995) affirm that the chapter is, in a way, an "anticlimatic", but also, in another way, "preparatory". To clarify the meaning of this statement, the readers of the Portuguese version of the book count on an enlightening note made by the translators Carolina Bori and Rodolpho Azzi, who say: "in both 1964 [year of the first translation] and 1950, the social behavior continues to be seen by two main points of view. One treats social behavior in term of stimuli and responses, in which there's more than one organism interacting, and it applies the same scientific methods and the same fundamental behavior principles to organisms in groups, as well as isolated organisms. The other point of view defends a special science ("social"), with laws, forces and units that require a basically different scientific orientation", (the translators' note of the first Portuguese translation of Keller & Schoenfeld, 1950/1966, pp. 415-416).

The two points of view reveal an old dichotomy between natural sciences and social sciences that persist to these days in the field of knowledge production. This dichotomy, especially in Psychology, may be one of the reasons of the difficulty discussed by Guerin (1992) in having social Psychologists interacting with behavior analysts. Guerin points out that behavior analysts have advanced on the investigation of phenomena such as "cooperation, competition, social comparison, help, beliefs and interdependency processes" (p. 1423). Despite these advances, social Psychologists are frequently interested in how people interpret and think these processes, what demand concepts apart from those derived from a natural science applied to the study of human behavior. The interest in behavior is only justified as means of access to cognitive processes that act as mediators of the social behavior (Markus & Zajonc, 1985).

Guerin (1992) finds in the verbal behavior analysis (Skinner, 1957) instruments for the comprehension of how social knowledge is constructed – knowledge that a

person develops in contact with their social environment, interacting with other people. With these instruments, Guerin contribute for the discussion of classic themes of the social Psychology such as the notion of social representation. By using verbal behavior to analyze common questions in behavior analysis, social Psychology and social sciences, Guerin provide an analysis of social phenomena based on instruments of a (natural) science concerned with concepts to describe human behavior in all its levels of complexity.

The abandon of inferred cognitive processes can be seen as a present example of the "anticlimax" promoted by behavior analysts in dealing with social phenomena. Like Keller and Schoenfeld (1950/1995), Skinner (1953) insisted that the social behavior analysis requires no new behavioral principles, but the description of how basic behavioral principles function when the environment in which a person behaves is the behavior of another person. The "preparatory" stance of Keller and Schoenfeld was, in turn, successful: it was a first step to show that social problems which humanity faces today may be characterized as behavioral problems (Cone & Hayes, 1980). This same stance allows taking to the nonhuman laboratory simulations of complex human behavior. In the Columbam Project, for example, the social behavior of pigeons was investigated leading to the construction of experimental models of symbolic communication (Epstein, Lanza, & Skinner, 1980), use of memoranda (Epstein, & Skinner, 1981), lying (Lanza, Starr, & Skinner, 1982) etc. More recently, in the same line, experimental models of communication based in private events (Lubinski & Thompson, 1987) and symbolic aggression (Andronis, Layng, & Goldiamond, 1997) were developed with pigeons. All these experimental models are committed with the notion of contingencies of reinforcement as the basic unit to describe social behavior and dispense with concepts of a "special science ('social')". The important factor, in all these cases, is that the critical environmental variables are provided by the behavior of another individual of the species.

Metacontingencies and the third level of selection by consequences

According to the causal mode of selection by consequences (Skinner, 1981), the behavior of human beings is product of variation and selection processes that occur in three levels: phylogenetic, ontogenetic and cultural. The phylogenetic level belongs to the natural selection and encompasses the species evolution history; the ontogenetic level corresponds to the reinforcement contingencies which operates throughout the particular life history of an individual; finally, the cultural level consists of the "special contingencies" maintained by a social environment and involves the evolution history of cultural practices in a certain group of individuals. Therefore, according to this causal mode, both the individual behavior and the cultural practices are selected and maintained by their consequences. When arguing that human behavior also depend on the special contingencies maintained by a developed social environment, Skinner (1988) states that no new behavioral process would be involved, but only a different kind of selection.

Skinner's position (1981, 1988) opens the question about the unit of analysis to describe the selection of human behavior. Skinner (1966) discussed the behavior analysis unit with the notion of the operant reinforcement contingency. Such a unit of analysis requires the identification of functional relations between an organism response, the context in which it occurs and the selecting consequences produced by the response.

Even assuming that no new processes would be involved in the cultural evolution, several behavior analysts have questioned the adequacy of the reinforcement contingency as a unit of analysis to describe the third level of selection by consequences (e.g., Andery, Micheletto, & Sério, 2005; Andery & Sério, 1997; Glenn, 1986; 1988; 1989; 1991; 2003; 2004; Glenn & Malott, 2004; Malott & Glenn, 2006; Sampaio & Andery, 2010; Skinner, 1953; Todorov & Moreira, 2005; Todorov, Moreira, & Moreira, 2005).

An important step in this questioning was taken by Glenn (1986) by proposing the concept of metacontingency as the unit of analysis to study the cultural level of behavior selection. In its most recent formulation, metacontingency has been described as a functional relation between interlocking behavioral contingencies (IBCs) which produce an aggregated effect (that could not be produced otherwise) and an external selecting event dependent on such effect, called cultural consequence (Malott & Glenn, 2006; Vichi, Andery, & Glenn, 2009). The term interlocking behavioral contingencies, on the other hand, has been used to delimit the unit of analysis of social behavior in which the behavior of each individual performs a double role —the role of

action and the role of behavioral environment for the action of another individual (Glenn, 1991; Skinner, 1953, 1957).

The analogy of the metacontingency (cultural contingency) with the contingency of reinforcement notion is clear: the cultural consequence acts on the IBCs and their aggregated product, selecting them. Since the cultural consequence depends on the behavior of more than one individual, it is the IBCs, and not the individuals' behavior, that are selected (Glenn, 1988). The selection of individual behaviors, in turn, depends on the individual consequences, usually distinct from the cultural consequences, which act independently on the behavior of each organism. It is noteworthy that cultural selection does not dispense with the operant selection: the metacontingency acts on the IBCs, which involve behaviors mainteined by specific reinforcers.

Speaking on selection of interlocking contingencies implies the assumption that, in a social system, what is analyzed as environmental variable (social consequence and social antecedent stimulus) also follows behavioral laws, which means that it is also susceptible to the selective action of reinforcing consequences. In a metacontingency, IBCs are selected when they function as a cohesive whole that interact differentially with the external selecting environment (Glenn, 2003). By dealing with cultural selection contingencies, both Skinner (1953) and Glenn (1991) highlighted that the reinforcing consequences produced by the joint action of more than one individual exceed the sum of consequences that could be separately produced by each one.

Finally, to talk about selection and maintenance of cultural practices in the third level of selection by consequences, it is necessary to verify the systematic recurrence of IBCs, and their aggregated product, even with the substitution of participating individuals. It is the propagation of similar, learned behaviors throughout successive individuals that distinguishes a cultural practice from any other social phenomenon (Glenn, 1991; 2003; Sampaio & Andery, 2010; see also Baum, Richerson, Efferson, & Paciotti, 2004).

Experimental studies of metacontingencies

Even though a relative long time has passed since the first formulation of the metacontingency concept by Glenn (1989), studies involving the production, in laboratory, of experimental analogues of metacontingencies began to be conducted only recently. The Vichi et al.'s (2009) study demonstrated experimentally the selection of IBCs and their aggregated products (equal or unequal distribution of earnings among participants in a betting game) by a cultural consequence (tokens exchangeable for money) contingent upon this product. Two groups of four undergraduate students were separately exposed to a game that began with the distribution of an equal number of tokens to each participant. On each trial, individual participants chose how many tokens to bet. Then, the group consensually chooses a row of an 8 x 8 matrix. After that, the experimenter communicated if the group's choice had been correct or incorrect. If the choice was announced as correct, the group earned twice as the tokens bet on the trial. If the choice was announced as incorrect, the group received half of the wagered tokens. After receiving the tokens, the group would decide how to distribute the earnings among themselves. Without the participants' knowledge, the criterion to declare a choice as correct or incorrect depended only on how the participants had distributed among themselves the earnings gained in the previous trial. In the Condition A, choices were considered as correct whenever, in the previous trial, the earnings had been equally distributed among participants. In the Condition B, the announcement of a correct choice depended on unequal distribution of earnings on the previous trial. Group 1 was exposed to an A-B-A-B reversal design and, Group 2, to a B-A-B design. The results showed that the cultural consequence (earning twice as tokens) selected the IBCs that resulted in earnings distributions according to the current experimental condition: systematically, both groups distributed to the tokens equally in the Condition A and unequally in the Condition B. The authors interpreted these results as demonstrating metacontingencies, even though the selecting cultural consequence may have coincided with the individual consequences. Since the tokens were the only reinforcers programmed for the task, it is hard to distinguish analytically the selection of the operant behaviors maintained by their own consequences from the IBCs maintained by an external consequence, contingent upon the production of a certain aggregated effect.

Experimental models of metacontingency have advanced on different analysis levels of selection when cultural consequences (collective), distinct from operant consequences (individual) are added. Pereira (2008,

Experiment 2), for example, exposes the participants to a computer task which screen presented two four-window rows, forming four columns of two vertically aligned windows. In other words, each window on the superior row corresponded to an immediately below window on the inferior row. In the beginning of each trial, the computer randomly presented a number from 0 to 9 in each superior window. The participant's task consisted equally in filling each inferior window with a number from 0 to 9. Immediately, the sum of the numbers filled by the participant was shown in another window, located just below the inferior row. At the center of the screen, a counter presented the points and another one the bonus accumulated throughout the task (the session began with 200 points and 0 bonus for each participant).

The experiment was composed of four experimental conditions. In the Condition 1, only one participant was present. In each trial, whenever the participant filled in a window with a number that summed to that supplied by the computer in the immediately above window (i.e., in the same column) resulted in an odd number, 100 points were added in the points counter and a sound characteristic of gain was presented. If the sum of numbers in each column resulted in an even number, 10 points were taken from the counter, along with a sound characteristic of error. This condition was finished after five consecutive trials with correct choices in all windows or after a total of 20 correct trials.

In the Condition 2, all of the first condition contingencies were kept and a second participant was introduced to the task. The computer screen was split in two identical parts, but with independent operation for each participant. After each participant independently fills your four rows, individual consequences were provided to each one. Once the same previously defined criterion was reached, Condition 3 began immediately, without any information to the participants. In this condition, in addition to the points produced individually, whenever the sum of the numbers inserted by the first participant (P1) was equal or higher than the sum of the numbers inserted by the second participant (P2), a sound characteristic of gain was produced and 300 bonus were added to the bonus counter of each participant. In the fourth and last condition, after the finishing criterion had been reached again, the systematic substitution of the participants (from the oldest to a new one) was done, ending the experiment after five substitutions. The results showed that the production bonus (cultural consequence) maintained the IBCs that produced the aggregated product "sum of P1 higher or equal to the sum of P2" ($\sum P1 \geq \sum P2$) in at least three generations of participants. Pereira (2008) also reproduced experimentally the fundamental characteristic of the cultural practices, the propagation of learned, similar behaviors throughout successive individuals. Thus, the main advance of Pereira's study in relation to Vichi et al., (2009) was showing more clearly the additional effect of a cultural consequence on the contingencies that had been maintaining the individual behavior of each participant of the experiment. Once both the points and the bonus could be independently produced, the design made it possible to analyze "the selection of operant behaviors maintained by their consequences and the selection of interlocking contingencies (formed by operant behaviors) which, by producing a certain aggregated product, were selected by external environmental consequences" (p. 45).

A series of others studies was conducted based on Pereira's (2008) design. To name a few, Caldas (2009) verified that, after the selection of IBCs that produced the aggregated product "$\sum P1 \leq \sum P2$", the suspension of the cultural consequence (bonus) had an effect analogue to the operant extinction upon the IBCs. Bullerjhann (2009) systematically replied to Pereira's study, all well as its results, increasing the number of participants in each generation from two to four. Finally, Vieira (2010), of special interest to the present proposal, demonstrated that different patterns of IBCs can be put under control of previous stimulus conditions with discriminative functions, and that the establishment of such a control generated processes analog to generalization.

In Vieira's (2010) study, three participants worked simultaneously, each one in a computer, being designated as RP, CP and LP according to their relative positions (right, center and left). The individual contingencies were identical to the ones implemented by Pereira (2008). However, two metacontingencies operated on relations between the products of participants' behavior. When the screen was blue, if the sum of the four numbers inserted by LP was lower than the sum of CP, which in turn was lower than the sum of RP ($\sum LP < \sum CP < \sum RP$), a cultural consequence (bonus) was produced. Inversely, when the screen was red, and the production bonus was contingent upon any sum that produced the following result: $\sum LP > \sum CP > \sum RP$. In each trial, the color of the screen alternated between blue

and red randomly. The results showed the establishment of both metacontingencies, since blue and red colors acquired evocative control over each correspondent IBCs. Furthermore, posterior tests verified the generalization of stimuli control, from blue to light blue and purple, and from red to pink and orange.

The series of experiments described above illustrates the way in which the use of experimental strategies can strengthen and clarify the concept of metacontingency. Such an approach may improve the complex analysis of human behavior in social systems composed of many IBCs. The experimental data also contribute to demonstrate something fundamental, that the metacontingency does not involve any new behavioral process (Glenn, 2004; Skinner, 1988). Therefore, at least in theory, metacontingencies could control not only human behavior, but also nonhuman. However, would the behavior controlled by metacontingencies be characteristically human considering the possibility that verbal behavior is the necessary glue to maintain IBCs, as Glenn (1991) stated?

By researching with humans, it is not possible to evaluate whether verbal behavior is necessary or sufficient for selection by metacontingencies or if it is just one of the effects of cultural selection. Glenn's position on the role of verbal behavior for cultural selection has recently received support in the experimental investigation. Sampaio et al, (2011, September) compared participants who could or not talk while working on a task that allows the production of only individual consequences or individual consequences upon which collective consequences were added. The authors verified that, in the absence of verbal behavior among participants, metacontingencies selected IBCs with less easiness, consistency and speed in relation to what was observed to the participants that could talk during the experimental task. In these, would the verbal behavior have been determinant of the IBCs selection or just one of the effects of cultural selection?

Metacontingencies in nonhumans

As stated by Skinner (1969), "despite been said sometimes that researches with inferior animals make it impossible to find out what it characteristically human, it's only by studying the behavior of inferior animals that we can say what is characteristically human. The dimensions of what seems to be human have been progressively reduced when we started to better understand the inferior subjects" (Skinner, 1969, p. 250). Naturally, this also seems true in regard to metacontingencies. A study conducted by Skinner (1962) with pigeons suggests that the selection by metacontingencies may be verified in nonhumans, in a controlled situation of laboratory. Reviewing Skinner's study after the model of selection by consequences and the notion of metacontingencies can be an important starting point for the construction of experiments in the field of cultural selection.

Skinner used an operant conditioning box split in the middle by a transparent glass wall containing a feeder on each side. Right next to the glass wall, in both sides of the box, there were three vertically aligned response keys, in a way that each key, on one side, was horizontally aligned to a correspondent key of the same height, on the other side. The keys were always illuminated by red, but, at each moment, only one pair of same-height-key was randomly designated as effective for food production. In the first experimental condition, two pigeons were separately trained to explore its corresponded column until they found the key on which a peck produced the activation of the feeder. In the second condition, both the pigeons were inserted in the box at the same time and the feeders would operate only if the pigeons pecked the pair of keys previously designated as effective, with a maximum of a 0.5 s gap between the pecks of each one. In other words, to produce food, the pigeons had to cooperate in two tasks: explore the three pairs until the effective pair was found and simultaneously peck both keys of that pair. Skinner reported that, after a short period without responses, probably caused by the other pigeon in the box, both subjects started pecking the keys and, eventually, activated the feeder. In a short time, however, the visual stimulation supplied by a pigeon pecking on a key became a discriminative stimulus controlling the other pigeon's behavior of pecking the corresponding key, located in its side of the box. Then, the pigeons started to systematically produce the activation of the feeder with suck coordination that the gaps between each pecks was so sort that gives the "impression of on pigeon seen in the mirror" (p. 533). Another interesting result reported by Skinner was that there was a division of labor concerning the two tasks" (p. 532-533). One pigeon, the "leader", explores the keys pecking one by one unsystematically. The other pigeon, the "follower", accompanies the leader pecking whichever

key corresponds to the one that the leader had pecked. In addition, it was observed that the roles of leader and follower are not inflexible, but may shift from one pigeon to another throughout the experiment.

Skinner (1962) reproduced what Hake and Vulkelich (1972) later defined as a basic procedural unit of cooperation. For these authors, a cooperative procedure must guarantee "(1) that the reinforcers of both individuals are at least in part dependent upon the responses of the other individual, and (2) that the procedure allows such responses, designated as cooperatives responses, to result in an equitable division of responses and reinforcers" (p. 333).

Skinner's results can also be interpreted in light of the concept of metacontingency. It is possible to argue that the activation of the feeder ("cultural consequence") selected the IBCs (responding under control of the behavior the other subject) and its aggregated product (simultaneously pecking the same-height-key pair). However, as in the study of Vichi et al. (2009), the only way of producing the activation of the feeder was by the coordinated action of both subjects, providing no comparative parameter with a situation in which only control by individual of contingencies were in force. In the absence of these parameters, the role of the contingency acting upon the individual behavior of each subject could not be sufficiently evaluated in relation to the one that act upon the aggregated product of the coordinated behavior of both subjects. In addition, there was no substitution of already trained subjects for subjects new in the task, which would offer information about the maintenance of the IBCs beyond the isolated subjects' repertoires.

Therefore, an animal model of metacontingency should unequivocally reproduce the cultural selection unit of analysis, in order to test its generality in non-verbal subjects and, thus, to point out the necessary and sufficient conditions for the selection and maintenance of IBCs across successive individuals. Once the unit of analysis of cultural selection proves to be reproducible in nonhuman subjects, a metacontingency animal model could offer a stable baseline for testing the effects of many independent variables upon the selection and maintenance of IBCs. Naturally, the choice of which independent variables to manipulate should be guided by the search for similar important aspects of the contingencies typically observed in the human social environment. For example, it could be investigated the differential effects of the equal vs. unequal division of the cultural consequence between the subjects or the requirement of responses with different costs from each subject. It could also be relevant to evaluate the effects of delay in the presentation of the cultural consequence on selection and maintenance of IBCs in animals and if the use of conditioned reinforcers can help supplanting such effects. Also, the effects of different schedules of reinforcement for individual contingencies and for the metacontingency should be tested.

Metacontingencies in nonhumans: An experimental proposal

An ongoing study in our laboratory aimed to develop an experimental analogue of metacontingency in pigeons, using a method based on Skinner's (1962) and Vieira's (2010) studies. The procedure allows for the evaluation of (1) the effect of the "cultural consequence", produced by IBCs that generate a certain aggregated effect; (2) the establishment of an antecedent stimulus condition for each one of the two metacontingencies; and (3) the appearance of "cultural practices" by the systematic substitution of the subjects.

For this study, an operant conditioning box split in the middle by a transparent Plexiglas wall containing, on each side, a feeder and two vertically aligned response keys (Figure 1) was built. Each key, on one side of the box, is horizontally aligned to a correspondent height key located inside the adjacent box. Throughout the study, which will be composed by three experimental conditions, the subjects will work side by side in a way that each pigeon will be able to clearly visualize the other one's behavior.

The data collection has already started. In the first experimental condition, two pigeons are being trained to peck only one key per trial, alternating between the two keys during the trials. On each trial, the four disks (two on each side) are simultaneously illuminated with the same color (green on red). Each subject works individually, producing 4-s access to the feeder whenever a peck to one of the keys is emitted, after 10 s of the beginning of the trial, no matter what color it is (individual contingency).

After the performances are established, ensuring key alternations throughout the trials, the second experimental condition will begin, keeping the previously established

individual contingencies intact. In this condition, metacontingencies will be introduced. With the keys illuminated by red, if both subjects respond at the same height (both in the superior keys or both in the inferior keys), the first response after 10 s of the beginning of the trial will produce, in addition to the usual 4-s access to the feeder, its activation for other extra 4 s (analogously called of cultural consequence); if the subjects peck keys of different heights (one, the superior key, and the other, the inferior key), only 4-s access to the feeder will be available. However, when the keys are illuminated by green, responses in keys of different heights will produce the addition of 4 s in the feeder duration; responses in keys of the same height will only produce 4 s of food. The subjects will be kept in this condition until the "cultural consequence" starts being systematically produced under control of the keys colors.

A third condition will test if the IBCs, selected in the previous condition, will continuously on being evoked under control of the corresponding colors throughout the successive generations. For that, we will proceed with a systematic substitution of subjects.

Evidences of the selection by metacontingencies will be considered if pairs of subjects consistently produce the "cultural consequences" under control of the corresponding green and red colors, in the second and third experimental conditions. This will indicate that this consequence, distinct from the individual consequence, had a selecting effect over the IBCs (responding in the keys under control of the other individual's behavior) and their aggregated products (responding in keys of the same height or of different height, depending on the presented colors). Evidences of "cultural practices" will be pointed out if the IBCs and their aggregated products are promptly maintained under control of the correspondent colors, even after the substitution of subjects. The establishment of the "leader" and "follower" roles, in each pair, will be contrasted with the higher or lower probability of maintenance of the "cultural practice" between the different generations of subjects. We believed that the maintenance of IBCs, in case they occur, would be more likely in the pairs in which the oldest member has been the follower in the previous pair. If the follower of the previous pair maintains this role when a new pair is formed, this subject will only have to wait the response of the new pigeon to respond accordingly to the specified colors. In this case, even with the new pigeon under control only of the experimental apparatus, the "cultural consequence" would be systematically produced across each new generation. On the other hand, if the roles of leader and follower prove to be interchangeable, as Skinner described, the maintenance of the metacontingencies in a higher number of generations can be expected.

Finally, in case the selection of IBCs and their aggregated products are not verified in any of the generations, a first experimental evidence that the unit of analysis of the cultural selection may be restricted in the scope of human social interactions can be supplied. Anyway, we expect to contribute for the cultural evolution epistemology.

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